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ANTARCTIC RECORDS OF ASTEROID-INFESTING ASCOTHORACIDA (CRUSTACEA), INCLUDING A NEW GENUS OF CTENOSCULIDAE

Mark J. Grygier

Abstract.—The following Ascothoracida parasitizing Antarctic asteroids are described and illustrated: an immature female *Dendrogaster* sp. cf. *antarctica* Grygier, and females and brooded offspring of *Gongylophysema asetosum,* new genus and species, all parasitic in *Odontaster validus* Koehler; several females and males of *D. usarporum,* new species, from *Porania antarctica glabra* Sladen. Females of both species of *Dendrogaster* have setose thoracopods, a new morphological feature for this genus. *Gongylophysema* is the most apomorphic genus of the Ctenosculidae and has numerous similarities witih the dendrogastrid genus *Ulophysema.* Its embryological development omits the nauplius, and the ascothoracid larva's medial penis originates as paired embryonic limb buds, a finding with implications for the entire Ascothoracida and Cirripedia. The sexes are separate by ascothoracid larva I. The opportunity is also taken to identify tentatively an historically enigmatic parasite of a Canadian brisingid asteroid as a ctenosculid ascothoracidan.

Ascothoracidans of the order Dendrogastrida are all crustaceans that parasitize echinoderms. Two members of this group have been described from Antarctica, *Dendrogaster antarctica* Grygier, 1980, a coelomic parasite of the asteroid *Acodontaster conspicuus* Koehler in McMurdo Sound, and *Ascothorax gigas* Wagin, 1968, a bursal parasite of the large ophiuroid *Ophionotus victoriae* Bell along the Antarctic Peninsula (and in the South Sandwich Islands) (Grygier 1981b, Grygier and Fratt 1984). Also, A. M. Clark (1962, 1977) mentioned an ascothoracidan, apparently a member of the family Ctenosculidae, in the asteroid *Acodontaster hodgsoni* forma *stellatus* (Koehler) from off MacRobertson Land. New records of *Dendrogaster* from two Antarctic asteroids are given in the present report as well as a new dendrogastridan genus, here assigned to the Ctenosculidae, from one of these same asteroids.

Class Maxillopoda Dahl, 1956
Subclass Thecostraca Gruvel, 1905
Superorder Ascothoracida
Lacaze-Duthiers, 1880
Order Dendrogastrida Grygier, 1987b
Family Dendrogastridae Gruvel, 1905
Dendrogaster Knipovich, 1890
Dendrogaster sp. cf. *antarctica*
Grygier, 1980
(nom. correct. pro *D. antarcticus*)
Fig. 1

Material.—Non-brooding ♀ (USNM 228260) from coelom of *Odontaster validus* Koehler also infested with *Gongylophysema asetosum,* new genus and species (see below), coll. G. Hendler, 25 Mar 1982, *Hero* Cr 824, Sta 30-1, 64°14.15′S, 62°33.60′W, 90–135 m.

Description.—Transverse span of mantle 21.4 mm (Fig. 1A, B). Middle piece distorted, but longer than wide and tapered

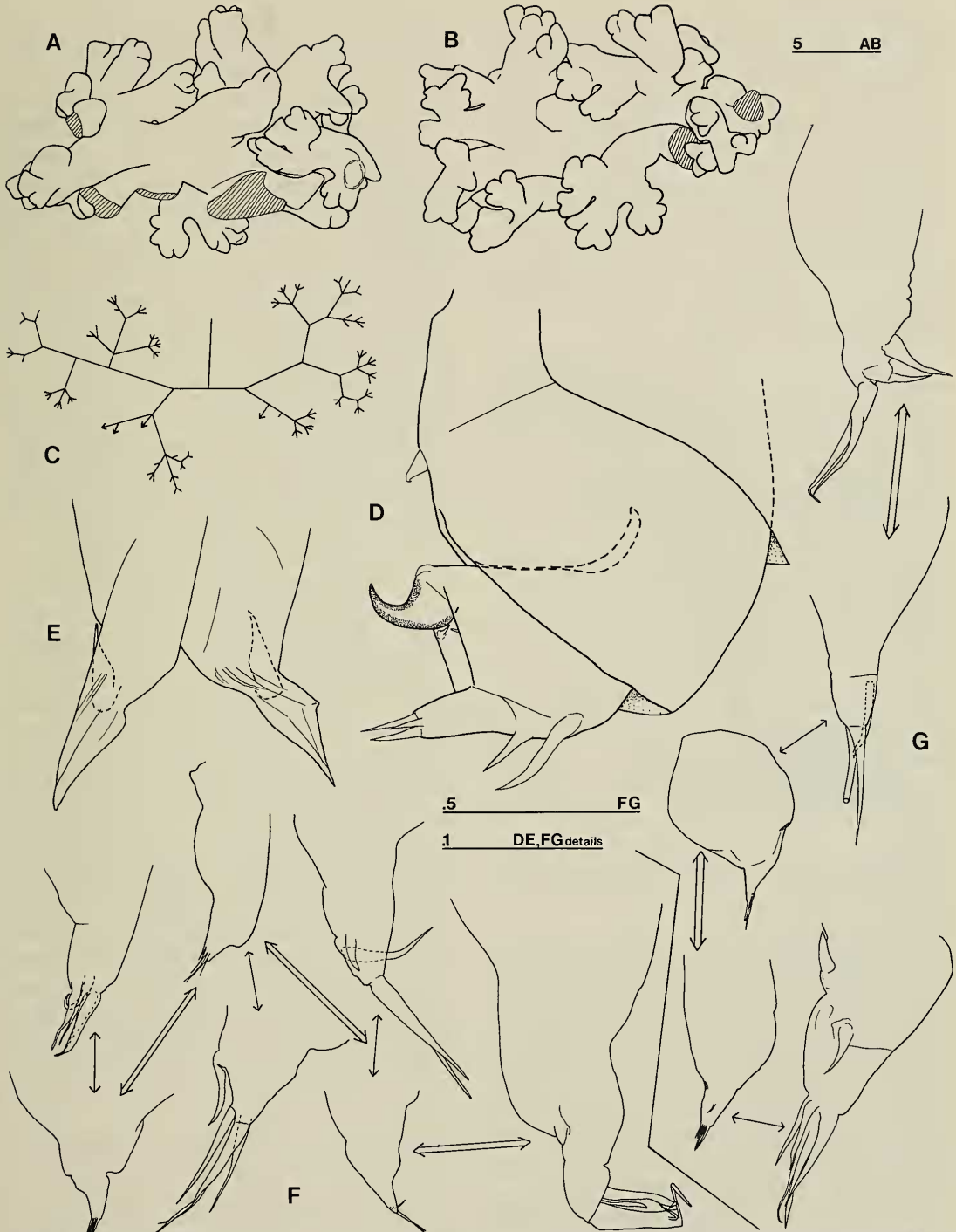

Fig. 1. *Dendrogaster* sp. cf. *antarctica* Grygier, 1980 (USNM 228260): A, B, Female, habitus, dorsal and ventral views, respectively, sites of missing branches hatched; C, Schematic diagram of mantle branching pattern (cf. A); D, Distal part of antennule, lateral view; E, Distal part of maxillae, posterior hooks dashed; F, G, 4 right and 3 left thoracopods, respectively, in order indicated by thick arrows (front and rear end of each series confused in dissection), fine arrows indicating details of thoracopodal tips, smallest limb in each series only shown in higher magnification. Scale bars in mm.

with distal slit. Tightly packed mantle branches short, stout, with lobular tips. Branching pattern shown in Fig. 1C: short main branch on each side dividing into anterior and posterior primary branches, these branching laterally or dichotomously up to as much as 5th-order terminal branches, last 2 orders of branching sometimes trichotomous; posterior branching possibly less well developed than anterior, but some posterior branches torn off. No ♂♂ found in middle piece or in main branches.

Antennules 4-segmented, subchelate, normal for genus (Fig. 1D). [Grygier (1981b) misdescribed the antennular segmentation in *D. antarctica*; segments 1–3 are arranged, and the third is armed, normally for the genus.] Segment 3 with fusion seam, its anterobasal muscle visible in 1 antennule only; small seta on anterior edge. Segment 4 much smaller than 3, with movable claw and fixed, slightly tapered claw guard; setation including: seta below claw (seen in 1 antennule); 2 setae on ridges between claw and claw guard, tiny lateral one on ridge edge (seen in 1 antennule), larger medial one on inside face of ridge, directed transversely; variably 2–3 apical setae on claw guard, another at its rear base; longer seta on ventral side of segment.

Maxillae bifid, with basally directed posterior hooks (Fig. 1E).

Thorax sac-like, with at least 7 setose, uniramous thoracopods, 4 on right (Fig. 1F), 3 on left (Fig. 1G). Order preserved in dissection, but anterior and posterior became confused. Legs typically consisting of broad, unarmed base and narrow, tapered distal part witih 3–5 terminal and 0–2 subterminal setae, all setae short and simple or occasionally bifid. One leg on each side, either first or last, much smaller than others.

Remarks.—The compact array of mantle branches, their stoutness, and the mixture of mantle branching geometries are characteristic of *D. antarctica*; no other *Dendrogaster* species is similar (Grygier 1981b). However, *D. antarctica* was originally described from *Acodontaster conspicuus* and its type specimens are at least twice as large as the present one and have a distally swollen middle piece and up to 9th-order branching. The present antennules differ from those of the type lot in having one small seta instead of two on segment 3, and two setae behind the claw guard instead of none. Since the present specimen is immature (not brooding), these differences may not be significant. Antennular setation is ontogenetically unstable in *Dendrogaster* and is not always a good taxonomic character compared with the mantle branching pattern (Karande and Oguro 1981a, b). More specimens from *O. validus* are necessary before a firm identification can be made.

The thoracopods are the most surprising feature of this specimen. Although Knipowitsch (1892) interpreted small, unarmed lobes as thoracopods in *D. astericola* Knipovich, 1890, females of *Dendrogaster* have generally been considered legless. The present exception, though spectacular, is not unique (also *D. usarporum,* new species, herein), and it may be that other females of this genus and of the closely related *Bifurgaster* Stone & Moyse, 1985, will prove to have similar legs if dissected properly. These reduced, uniramous, setose legs corroborate the supposedly close relationship of *Dendrogaster* to the third genus of Dendrogastridae, *Ulophysema* Brattström, 1936 (Wagin 1950, 1976; Grygier, 1987b), which is also so equipped (cf. Brattström 1948).

Dendrogaster usarporum, new species
Fig. 2

Diagnosis.—Middle piece about twice as long as wide; mantle branches very thick, anterior and posterior branching complex-

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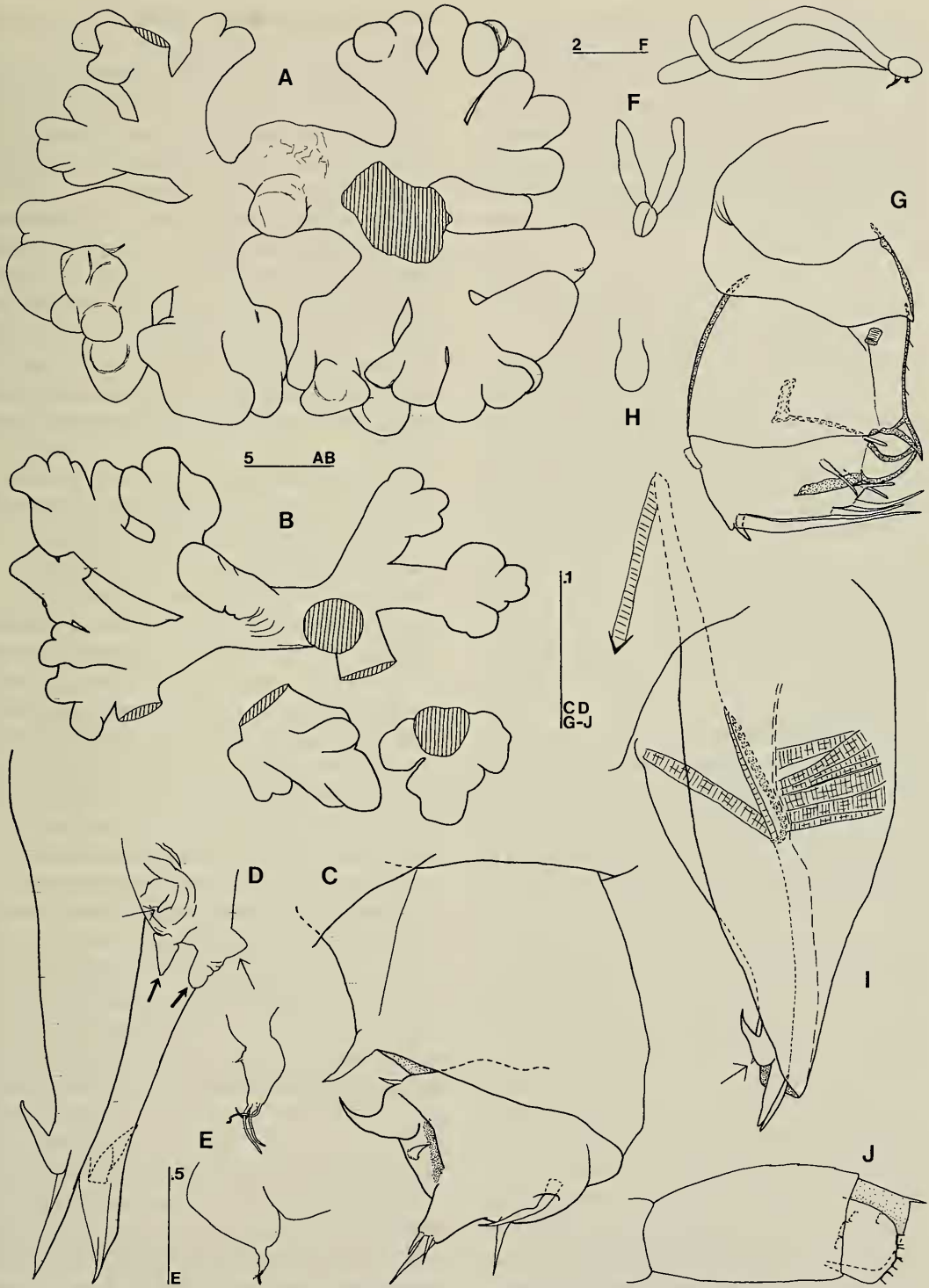
Fig. 2. *Dendrogaster usarporum,* new species: A–E, Females: A, Holotype (USNM 228256), habitus, wounds and missing branch sites hatched; B, Paratype and broken branches from it (USNM 228257); C, Distal part of paratype antennule, lateral view; D, Holotype maxillae, oblique lateral view, with vestigial mandibles (thin



arrows) and maxillules (thick arrows) at base; E, Holotype thoracopod (below) with detail of tip (above); F–J, Male paratypes (USNM 228257): F, Two males, habitus, lateral and dorsal views; G, Antennule, lateral view; H, Frontal filament; I, Oral cone, including some musculature (mostly of pharyngeal pump) and extra point on maxilla (arrow); J, Fifth abdominal segment and furcal rami, showing bases of 8 setae on near ramus. Scale bars in mm.

ity about equal; terminal branches generally tertiary, very large and rounded. Single large, spine-like seta on ♀ antennule segment 3; no muscle in anterobasal part of this segment. Males with cylindrical posterior processes, pad instead of aesthetasc on antennular segment 4, often small spines on seta-bearing prominance behind claw guard, small extra points on maxillae.

Etymology.—Named for the men and women of the United States Antarctic Research Program (USARP).

Material.—3 ♀♀ (holotype USNM 228256; paratypes USNM 228257) in coelom of 3 *Porania antarctica glabra* Sladen; coll. G. Hendler, 29 Mar 1982, *Hero* Cr 824, Sta 39-1, 64°47.51′S, 64°11.66′W, 226–265 m. Holotype and 1 paratype dissected. Holotype brooding round, 0.42 mm diameter eggs, 7 ♂ paratypes (USNM 228257) removed from middle piece, 1 left in main branch; dissected ♀ paratype with ripe ovaries but no brood or ♂♂; second paratype ♀ in poor condition, lacking tip of middle piece with appendages.

Description.—Females: Holotype mantle span 33 mm, paratypes 28–30 mm (Fig. 2A, B). Middle piece torn in holotype, 5.6 mm and 8.0 mm long in paratypes, about twice as long as wide, shape variable. Span of main branches about as long as middle piece, thicker than middle piece. Thick anterior and posterior primary branch on each side quickly dividing into 2–3 thick secondary branches, these breaking up into several round terminal branches from half to nearly as large as distal end of middle piece.

Antennule 4-segmented, subchelate (Fig. 2C). Segment 3 with 1 large, anterior, spine-like seta, a faint anterobasal fusion seam laterally, no muscle visible in cut-off corner. Segment 4 rounded, with movable claw and truncately conical claw guard; medial ridge between claw and claw guard more prominent than lateral one; small seta at base of claw; large lateral and tiny medial seta behind claw, former directed either upwards or transversely; 2–3 distal setae on claw guard, 1 longer than others; 2 setae arising separately behind claw guard, proximal one longer.

Holotype with vestigial mandibles and maxillules, maxillae well developed, bifid, with elongate posterior hooks directed basally, elongate distal prongs either straight or splayed outwards (Fig. 2D).

Post-cephalic part of body in dissected paratype segmented: first a wide zone with vestigial left thoracopod (massive base and appendix with 5 setae) and lobe medial to it (Fig. 2E), 2 unequal lobes on right; then a narrow, transverse ridge; then 3 progressively less broad, diaphanous bulges, the first possibly paired; then an unsegmented portion.

Males: Segmented, appendage-bearing main body between 2 oval valves about 0.8 mm long and 0.4 mm high, each with cylindrical, slightly curved or bent posterior process 1.9–6.2 mm long (Fig. 2F). Processes containing gut diverticulum and testes with typical bullet-headed sperm (Grygier 1981a). Body consisting of head, 6-segmented thorax (suture between first thoracomere and head clearly visible dorsally), and 5-segmented abdomen. Antennules 4-segmented, subchelate (Fig. 2G). Segment 3 with tiny hairs anteriorly, 2 anterodistal spines, lateral fusion seam, and small transverse muscle in delimited anterobasal region. Segment 4 with movable claw and tapered claw guard; seta at base of claw; longer one to each side behind claw; 1 short apical and 2 long, subterminal setae on claw guard; long seta (bifid in 1 case) behind claw guard arising from prominence with up to 2 short spines; small proximal pad corresponding to ventral aesthetasc of other *Dendrogaster* ♂♂. Pair of small, club-shaped frontal filaments present posterolateral to antennules (Fig. 2H). Oral cone normal, with conical labrum around bifid maxillae (Fig. 2I), rear hooks of latter pointing basally or distally, minute extra points medial to them.

Thoracomeres less high posteriorly; no long gap between oral cone and thoracopods; no epaulets on thoracomere 6; no limbs on thoracomere 1. Other 5 limb pairs

(thoracopods 2–6) of normal construction: coxa, basis, 2-segmented exopod, 3-segmented endopod except 2-segmented in thoracopod 6. Limb setation examined in 3 ♂♂: lateral coxal seta on thoracopods 2–3, longer on 2; medial basal seta not visible on any leg in whole mount; 4 long terminal exopod setae (3 on exopod 6), apparently 3 long terminal endopod setae (one-half as long as others) plus 1 seta on second endopod segment (2 terminal setae only on thoracopod 6). Abdominal segments 2 and 5 longest, 4 shortest. Penis not visible in whole mounts. Furcal rami, as seen clearly in 1 specimen (Fig. 2J), square with normal setation: 3 basomedial, 1 mediodorsal, and 4 terminal setae, ventral one shortest; dorsal terminal spine present or not. Natatory setae of limbs and furca setulate.

Remarks.—The robustness of the branches suggests an affinity with *D. antarctica,* but the branching pattern is simpler and the terminal branches much larger relative to the middle piece. The dissected paratype, which has rather long secondary branches, superficially resembles *D. rimskykorsakowi* Wagin, 1950, but its branches are thicker and the clusters of terminal branches much larger. A single large spine on antennule segment 3 also occurs in *D. sagittaria* Grygier, 1985b, *D. arbusculus* Fisher, 1911, *D. punctata* Grygier, 1982, *D.* sp. cf. *antarctica,* and sporadically in *D. fisheri* Grygier, 1982 (Grygier 1982, 1985b, herein). In the present case, the apparent lack of an anterobasal muscle in this segment is probably real, since it could not be found in four antennules examined. The single reduced thoracopod has implications discussed above.

The males are entirely typical of the genus except for the minute extra point on each maxilla; a larger such point has been described in specimens attributed to *D. beringensis* Wagin, 1957 (Grygier 1985b), but not in any other species. The posterior hooks on the maxillae are clearly movable, being found in more than one position, so their directionality cannot be used as a taxonomic character (e.g., by Wagin 1950). The anteriorly bounded first thoracomere is noteworthy since it is usually described as fused to the head in this genus.

Finding vestigial mouthparts in either sex probably depends on luck in dissection, so their reported presence or absence should not be used as taxonomic criteria in this genus.

Family Ctenosculidae Thiele, 1925
Gongylophysema, new genus

Diagnosis.—Female carapace spherical or subspherical with thin cuticle; small, protruding, ventral aperture guarded by spines and hooked setae. Cephalic attachment zone semi-inverted. Antennules apparently absent. Labrum short, its edges well separated; mandibles absent; maxillules present as rounded lobes; maxillae large, mostly fused except for short, bifid tips. Thorax enlarged, especially anteriorly, with long medial dorsal horns on segments 2–5 and 6 pairs of uniramous, asetose limbs, sixth much smaller than rest. Short filamentary appendages present. Seminal receptacles in legs 2–5. Penis absent. Abdomen 4-segmented. Furcal rami pointing ventrally, tapered with very few or no setae. Sexes separate by ascothoracid larva, adult males unknown. Inhabiting internal integumental cysts in asteroids.

Etymology.—From Greek *gongylos* (ball) and *physema* (bubble), referring to the shape of the carapace; gender neuter.

Type species.—*Gongylophysema asetosum,* new species.

Gongylophysema asetosum, new species
Figs. 3, 4

Diagnosis.—As for genus.

Etymology.—Referring to the basically asetose thoracopods and furca.

Material.—11 ♀♀ (holotype USNM 228254, 10 paratypes USNM 228255) inhabiting internal cysts in 3 *Odontaster validus,* 9 in specimen shared with *Dendrogaster* sp. (see above), 1 immature and 2

Fig. 3. *Gongylophysema asetosum,* new genus and species, paratype females (USNM 228255): A, Armament of carapace aperture; B, Main body, thoracomeres 2–6 and abdominal segments numbered, s, seminal receptacles; C, Oral cone showing maxillules (mx) flanking pointed maxillae, e, esophagus; D, Set of thoracopods, numbered,

mature paratypes dissected, carapace opened in holotype and another paratype. Coll. G. Hendler, 25 Mar 1982, *Hero* Cr 824, Sta 30-1, 64°14.15′S, 62°33.60′W, 90–135 m.

Host-parasite relations.—Each parasite lies within the host's disc or arm in a thin, tough pocket of host tissue (invaginated integument?) which separates it from the coelom. Access to the external medium is maintained through a minute slit in the host's aboral wall at the site of the carapace aperture (i.e., the parasite is normally upside down). This is nearly the same relationship as *Endaster hamatosculum* Grygier, 1985c, has with its zoroasterid starfish hosts (Grygier 1985c), but the cyst wall here lacks calcareous elements. Large cysts may be evident externally as bumps. The dermal ossicles of *O. validus* are normally ornamented with many small spinules, but in the vicinity of many cysts only bare knobs remain, and there are no papular openings around the slit. Cysts are roughly spherical or slightly wider than thick, mostly 3–7 mm across, but down to 1.5 mm. Some cysts from host arms bear imprints of the ambulacral plates against which they have grown.

Description.—Carapace roughly spherical, usually slightly wider than high or long, nearly same size as enclosing cyst (holotype 6.7 × 6.4 mm, a dissected paratype 7 × 6.5 × 6.0 mm). Short aperture on small ventral prominence, cuticle thickest there, with pores. Narrow zone of spines and hooked setae along aperture lips (Fig. 3A), then wider zone of hooked setae, most of surface smooth, unarmed. Diverticula of ovaries and midgut ramifying extensively within carapace.

Body attached by partly inverted head to anteroventral side of carapace, thorax curved so abdomen points ventrally toward aperture (Fig. 3B). Head bearing oral cone; no antennules, antennae, or frontal filaments found. Thorax 6-segmented, no boundary discerned between first segment and head. Thoracomeres 1–5 enlarged dorsally, but not greatly widened. Front and rear borders of first segment indistinct. Thoracic segments 2–5 each with a hirsute, forwardly curved, presumably movable (internal muscles present), dorsal protrusion or "horn," first one much shorter than others; horns relatively much shorter in smallest, immature, dissected individual. Dorsum of thoracomere 1 (region anterior of base of first horn) of variable length, short in holotype, quite long in illustrated paratype (Fig. 3B), intermediate in other examined paratypes. Filamentary appendages and 6 pairs of thoracopods present. Abdomen 4-segmented, tapered and ending with furcal rami, segment 1 larger than other 3 combined.

Labrum relatively short, its edges far apart, exposing most of maxillae (Fig. 3C). Mandibles apparently absent. Maxillules reduced to pair of round lobes (identity judged on basis of extrinsic musculature [Grygier 1984]). Maxillae large, basal region projecting ventroposteriorly, medially fused for most of length; tips bifid, immovable, barely projecting from fused portion. Prominent pair of maxillary gland swellings between oral cone and thoracopods 1, this the widest part of main body. Thoracopods 1–5 elongate, uniramous (Fig. 3D), lacking true setae but bearing short, fine hairs, leg 2 longest, then 1 and 3, 4 and 5 somewhat shorter. Leg 1 attached higher on body than others, with ♀ genital opening anteriorly at base and filamentary appendage with numerous short projections anterodorsal to that (Fig. 3D, E). Cluster of short, tubular seminal receptacles basolaterally within legs 2–5. Thoracopod 6 uniramous, naked, much smaller than other legs (Fig. 3D). No penis observed on first abdominal segment. Furcal rami ta-

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with filamentary appendage (f) and sites of seminal receptacles (s) indicated, latter only drawn in leg 2; E, Detail of a filamentary appendage; F, Furcal ramus of different specimen from B. Scale bars in mm.

pered or bluntly triangular, longer than high, surfaces heavily hirsute, but only 0–2 short distal setae (Fig. 3B, F).

Developmental stages.—Holotype brooding about 275 embryos and hatched ascothoracid larvae I. One dissected paratype with 314 ascothoracid larvae I ready to molt to ascothoracid larva II, 2 other large paratypes with about 450 embryos and about 400 eggs, respectively. Embryological development proceeding directly to ascothoracid larva, no naupliar stage.

Eggs: Oval, 0.51 × 0.42 mm.

Early embryos (Fig. 4A): Helmet-shaped, 0.73 mm long, 0.56 mm wide, 0.54 mm high, filled with yolk or oil gobules, ventrolateral rim produced into small anteroventral flaps and larger posterior protrusions. Unarmed antennules extending beyond rim, state of other appendages unclear.

Late embryos (Fig. 4B, C): Dome-shaped, yolk- or oil-filled shield over cephalic appendages and posteriorly protruding thoraco-abdomen. Shield 0.46 mm long, 0.41 mm wide, 0.36 mm high, total length 0.66 mm. Appendages present as unarmed anlagen: antennules longest, with or without distal notch; labrum rounded; antennae and mandibles absent; maxillules smaller than maxillae, both uniramous; 6 pairs of biramous thoracopods, endopod more narrow than exopod; pair of lobes behind them, presumably representing genital limbs; short furcal lobes.

Ascothoracid larva I: Carapace bivalved, oval, averaging 0.84 mm long. Sexes separate, some specimens with bundles of elongate sperm in carapace valves, others with immature ovaries. Body with head, 6-segmented thorax (first segment not distinct from head), and 4-segmented abdomen (Fig. 4D). Head bearing large, approximately 4-segmented antennules, small frontal filaments, labrum and maxillae (maxillules not seen, probably present). Antennules Z-shaped (Fig. 4D); penultimate segment with about 4 anterodistal setae; distal segment with large, probably immovable claw with 3 short basal setae, short cylindrical claw guard with 2 setae, long seta behind claw guard, and protrusion with tiny sensillum. Frontal filament short with 2 unequal, short processes (Fig. 4E). Labrum a flat shield in front of and shorter than maxillae, edges folded back, hiding any other mouthparts (Fig. 4D, F). Maxillae separate for much of length, tips with 1–3 small points (Fig. 4D, F). Six pairs of biramous thoracopods with long setae (half as long on first pair) (Fig. 4D, G, H). Legs divided into coxa, basis, 2-segmented exopod, and 3-segmented endopod (2-segmented in legs 1 and 6, first segment very short in leg 1). Exopods with 3 terminal and 1 slightly subterminal setae, just 3 terminal setae on leg 6. Endopods with 1 short seta on second segment (none on proximal segment of leg 1), 2 long setae on terminal segment. Abdominal segment 4 longest, others approximately equal (Fig. 4D). Penis of segment 1 sexually dimorphic, in males longer than legs, with 2 distal setae (Fig. 4I), in females less than half as long and unarmed (Fig. 4J). Furcal rami rectangular, just under twice as long as high, usually with 4 terminal and 3 mediodistal setae (Fig. 4D), but slightly variable.

Ascothoracid larva II: Some features of this stage could be made out beneath cuticle of older ascothoracid larvae I preparing to molt. Antennular claws sexually dimorphic, females with 10 ± 2 triangular teeth along inner curve (Fig. 4K), males with comb-like row of about twice as many, finer teeth (Fig. 4L). Impossible to determine number of antennular segments or whether strap-like aesthetasc present. Frontal filaments with relatively much longer aesthetasc than before. Sharp, pointed maxillules and apparently distally undivided maxillae present (Fig. 4F).

Remarks.—Systematic position: *Gongylophysema asetosum* has features characteristic of the Petrarcidae (Petrarcinae), the Dendrogastridae (Ulophysematinae), and the Ctenosculidae. The *Petrarca*-like fea-

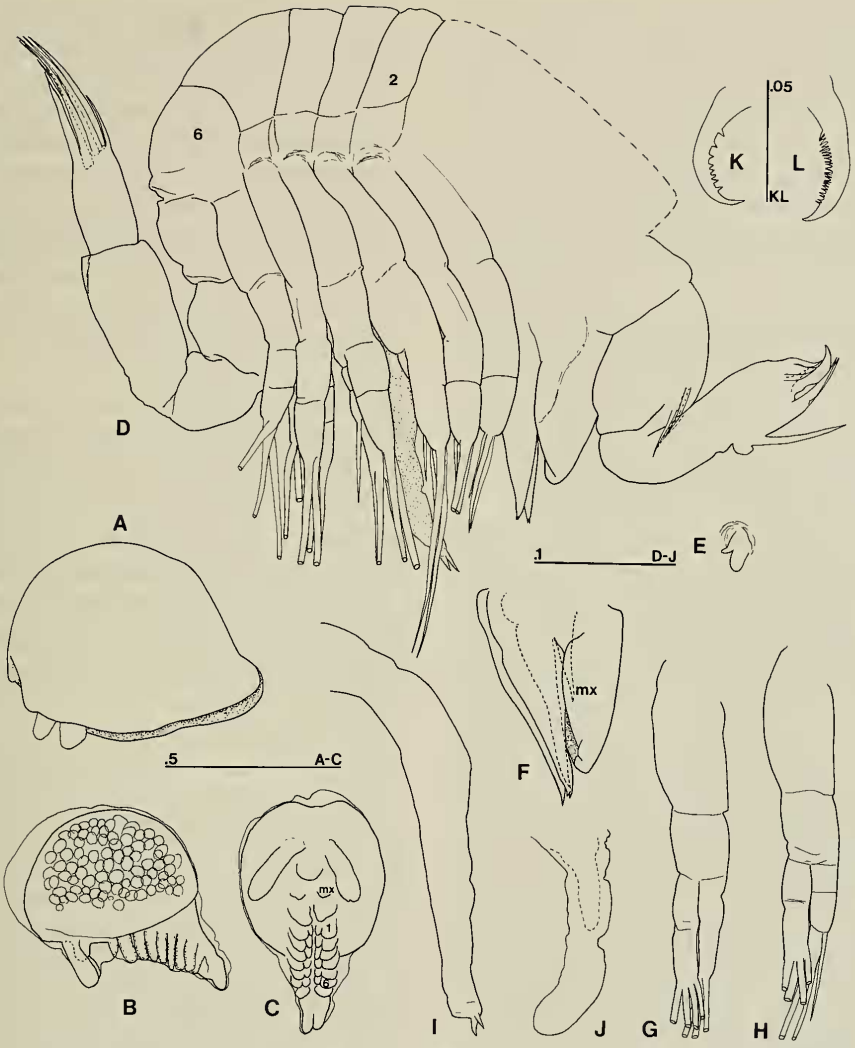

Fig. 4. *Gongylophysema asetosum,* new genus and species, developmental stages: A, Embryo, lateral view, front end left; B, C, Late embryos, lateral and ventral views respectively, latter showing appendage anlagen (e.g., mx, maxillule, thoracopods 1 and 6); D–J, Ascothoracid larva I; D, Main body, lateral view, some thoracomeres numbered, setae only shown complete on legs 1 and 3, penis stippled; E, Frontal filament; F, Oral cone, maxillules (mx) and longer maxillae of ascothoracid larva II dashed within; G, Thoracopod 1; H, Thoracopod 2; I, Male penis; J, Female penis with anlage of ascothoracid larva II penis dashed within; K, L, Female and male antennular claws, respectively, of ascothoracid larva II. Scale bars in mm.

tures include the oral cone—the short labrum with widely separated lateral margins and the labium-like, nearly fused maxillae (most similar to *Petrarca morula* Grygier, 1985a)—and the asetose, unsegmented limbs. The Petrarcidae infest scleractinian corals, and these resemblances must be convergent simplifications. Adult characters in common with *Ulophysema* include an at least partly inverted cephalic attachment zone, anteriorly curled, muscular thoracic horns on 4 thoracomeres (segments 1–4 in *Ulophysema*), uniramous thoracopods, loss of some mouthparts (all but labrum in *Ulophysema*), a ventrally pointed abdomen, and nearly asetose furcal rami (asetose or absent in *Ulophysema*). The sexual dimorphism of the ascothoracid larva II anten-

nular claw is the same as in *U. oeresundense* Brattström, 1936 (Grygier, 1987a), and that species also exhibits sexual differences in penis development at this stage. *Ulophysema,* however, shares so many advanced features with the dendrogastrine genera *Bifurgaster* and *Dendrogaster*—nearly identical, subchelate, larval antennules; loss of first thoracopod at all stages; loss of seminal receptacles; reduction of mandibles and maxillules; reduction of abdomen to 2 segments or less; great enlargement of carapace into lobes; complete or nearly complete endoparasitism—that these three dendrogastrid genera together must form a monophyletic set (Grygier, 1987b).

Gongylophysema shares a mode of life within an integumentary cyst of an asteroid with the ctenosculid genera *Ctenosculum* Heath, 1910 (see Grygier 1983a) and *Endaster* Grygier, 1985c. All three genera have vestigial or absent antennules, apparently no mandibles, a partly or wholly inverted cephalic attachment zone, large but simplified thoracopods (mostly biramous in *Ctenosculum* and *Endaster*) with small, tubular seminal receptacles in legs 2–5, no discernable penis in adult females, filamentary appendages, and an array of spines and hooked setae near the carapace aperture (last 2 features previously overlooked in *Ctenosculum*). *Gongylophysema* is assigned to the Ctenosculidae on the basis of these mostly apomorphic features. *Ctenosculum* has 4 dorsal horns on segments 1–4 or 2–5 and tapered filamentary appendages (based on new, Australian specimens and reexamination of Grygier's 1983a specimen); unlike *Gongylophysema* it has a large, toothed, posteroventral carapace aperture, setose legs and furca, and 2-segmented antennules. *Endaster* is similar to *G. asetosum* in carapace form aside from being more oval, and its abdomen points ventrally, but it has setose thoracopods and furcal rami, very long, conical filamentary appendages, and a completely different thoracic armament with no long dorsal horns. In both *Ctenosculum* and *Endaster* the oral cone is more generalized than in *Gongylophysema*; the rear edges of the labrum meet behind the other mouthparts. *Endaster* shows sexual dimorphism at ascothoracid larva I, involving penis development as well as gonads (Grygier 1985c). In sum, *G. asetosum* appears to be the most apomorphic (i.e., reduced) member of the Ctenosculidae in terms of mouthparts, thoracopods, and furcal setation; the thoracic horns suggest a close affinity to *Ctenosculum.*

Embryology: The seventh pair of trunk limb buds in this species can only reasonably be interpreted as rudimentary genitalia, yet the fully developed ascothoracid larva has a medial penis, as do adult ascothoracidans in general. This seems to confirm the assumption (e.g., Grygier 1983b) that the penis is the Ascothoracida (and Cirripedia) represented fused appendages of trunk segment 7.

Although retention of the brood to the ascothoracid larva is quite usual in the Ascothoracida, there normally are brooded naupliar instars. Direct development from the embryo to the ascothoracid larva, as seen here, only otherwise occurs in a few species of *Dendrogaster* (Wagin 1948, 1954; Grygier 1981b) as one end of a spectrum of ontogenetic patterns.

Notes on an unidentified ctenosculid.—H. L. Clark (1902) described a 15 mm long, bilobed structure (USNM 19899) collected at *Albatross* Sta 3342 (off Queen Charlotte Islands, Canada, 2900 m) as a monstrous possible holothurian. A. H. Clark (1916) reexamined the specimen and determined it to be a piece of a *Brisinga* (Asteroidea) arm with an external cyst induced by a "curious type of degenerate mollusc." Although this specimen is not Antarctic, it is worth treating in the present context because after examining the specimen, I have concluded that the parasite was most likely a ctenosculid ascothoracidan, of which only a portion of the carapace remains. Typically branched ascothoracidan ovaries are pres-

ent in the carapace. Among the Ctenosculidae, *Ctenosculum hawaiiense* Heath, 1910, infests a deep-water brisingid, so this parasite may possibly belong to that genus. A. H. Clark (1916) noted more cysts on *Brisinga* from the same station, but these specimens were not found at the Smithsonian in 1985, so the precise identity of the parasite cannot be determined.

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Department of Invertebrate Zoology, National Museum of Natural History, Smithsonian Institution, Washington, D.C. 20560.